

WHAT IS CLAIMED IS:

1. An electrostatic ejection type ink jet head that uses ink containing a charged fine particle component, controls ejection/non-ejection of the ink by means of an electrostatic force by applying a predetermined voltage to individual electrodes in accordance with image data, and records an image corresponding to the image data on a recording medium,

the electrostatic ejection type ink jet head comprising:

a head substrate;

first drive electrodes provided for each of the individual electrodes;

a second drive electrode provided commonly among all of the individual electrodes;

ink guides arranged on the head substrate for each of the individual electrodes; and

an insulating substrate in which through holes are established for each of the individual electrodes at a position corresponding to an arrangement of the ink guides,

wherein the head substrate and the insulating substrate are arranged with a predetermined space therebetween, a flow path of the ink is formed between the

head substrate and the insulating substrate, the ink guides are passed through the through holes established in the insulating substrate, tip portion of the ink guides are protruded above a surface of the insulating substrate on a recording medium side, the first drive electrodes are arranged closer to the insulating substrate side than the flow path of the ink, and the second drive electrode is arranged closer to the head substrate side than the first drive electrodes, and

at the time of recording of the image, ejection/non-ejection of the ink is controlled by biasing the second drive electrode to a predetermined voltage level having the same polarity as the fine particle component contained in the ink and switching the first drive electrodes between a high-impedance state and a ground level in accordance with the image data.

2. The electrostatic ejection type ink jet head according to claim 1, further comprising an electrophoretic electrode provided commonly among all of the individual electrodes and arranged closer to the head substrate side than the ink flow path,

wherein the time of recording of the image, the electrophoretic electrode is biased to a predetermined

voltage level having the same polarity as the fine particle component contained in the ink.

3. The electrostatic ejection type ink jet head according to claim 1, further comprising a third drive electrode provided commonly among all of the individual electrodes and arranged closer to the recording medium side than the first drive electrode,

wherein at the time of recording of the image, the third drive electrode is biased to a predetermined voltage level having reversed polarity as the fine particle component contained in the ink.

4. An electrostatic ejection type ink jet head that uses ink containing a charged fine particle component, controls ejection/non-ejection of the ink by means of an electrostatic force by applying a predetermined voltage to a plurality of individual electrodes arranged in a two-dimensional manner with reference to a first direction and a second direction in accordance with image data, and records an image corresponding to the image data on a recording medium,

the electrostatic ejection type ink jet head comprising:

a head substrate;

first drive electrodes and second drive electrodes provided for each of the individual electrodes to form a two-layered electrode structure;

ink guides arranged on the head substrate for each of the individual electrodes; and

an insulating substrate in which through holes are established for each of the individual electrodes at a position corresponding to an arrangement of the ink guide,

wherein the head substrate and the insulating substrate are arranged with a predetermined space therebetween, a flow path of the ink is formed between the head substrate and the insulating substrate, the ink guides are passed through the through holes established in the insulating substrate, tip portion of the ink guides are protruded above a surface of the insulating substrate on a recording medium side, the first drive electrodes are arranged closer to the insulating substrate side than the flow path of the ink, the second drive electrodes are arranged closer to the head substrate than the first drive electrodes, the first drive electrodes on each line of the plurality of individual electrodes arranged in the first direction are connected mutually, and the second drive electrodes on each line of the plurality of individual

electrodes arranged in the second direction are connected mutually, and

wherein the ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the second drive electrodes on all lines of the individual electrodes in the second direction are set to a high voltage level or a ground level in accordance with the image data under a state where the first drive electrodes on one line of the individual electrodes in the first direction are set under a high-impedance state and the first drive electrodes on all remaining lines of the individual electrodes in the first direction are set to a ground level while sequentially changing the first drive electrodes on the line of the individual electrodes in the first direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are set to a high-voltage level or the ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under the high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second

direction are set to the ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are set under the high-impedance state.

5. The electrostatic ejection type ink jet head according to claim 4, further comprising:

guard electrodes that are provided between the lines of the first drive electrodes in the first direction and is biased to a predetermined certain voltage level at the time of recording of the image,

wherein the ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the first drive electrodes on all lines of the individual electrodes in the first direction are set to a high voltage level or a ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under a high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are at a ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second

direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are turned on or off in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are turned on and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are turned off while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are turned on.

6. An electrostatic ejection type ink jet head that uses ink containing a charged fine particle component, controls ejection/non-ejection of the ink by means of an electrostatic force by applying a predetermined voltage to a plurality of individual electrodes arranged in a two-dimensional manner with reference to a first direction and a second direction in accordance with image data, and records an image corresponding to the image data on a recording medium,

the electrostatic ejection type ink jet head comprising:

a head substrate;

first drive electrodes and second drive electrodes each provided for each of the individual electrodes to form a two-layered electrode structure;

ink guides arranged on the head substrate for each of the individual electrodes; and

an insulating substrate in which through holes are established for each of the individual electrodes at a position corresponding to an arrangement of the ink guide,

wherein the head substrate and the insulating substrate are arranged with a predetermined space therebetween, a flow path of the ink is formed between the head substrate and the insulating substrate, the ink guides are passed through the through holes established in the insulating substrate, tip portion of the ink guides are protruded above a surface of the insulating substrate on a recording medium side, the first drive electrodes are arranged closer to the insulating substrate than the flow path of the ink, the second drive electrodes are arranged closer to the head substrate side than the first drive electrodes, the first drive electrodes on each line of the plurality of individual electrodes arranged in the first direction are connected mutually, and the second drive electrodes on each line of the plurality of individual electrodes arranged in the second direction are connected

mutually, and

ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the second drive electrodes on all lines of the individual electrodes in the second direction are turned on or off in accordance with the image data under a state where the first drive electrodes on one line of the individual electrodes in the first direction are turned on and the first drive electrodes on all remaining lines of the individual electrodes in the first direction are turned off while sequentially changing the first drive electrodes on the line of the individual electrodes in the first direction that are turned on, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are turned on or off in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are turned on and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are turned off while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are turned on, with the operation (i) being

performed under a state where the individual electrodes are arranged so that the number of lines of the individual electrodes in the second direction is larger than the number of lines thereof in the first direction and the operation (ii) being performed under a state where the individual electrodes are arranged so that the number of lines in the first direction is larger than a number of lines in the second direction.

7. The electrostatic ejection type ink jet head according to claim 6,

wherein the ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the second drive electrodes on all lines of the individual electrodes in the second direction are set to a high voltage level or a ground level in accordance with the image data under a state where the first drive electrodes on one line of the individual electrodes in the first direction are set under a high-impedance state and the first drive electrodes on all remaining lines of the individual electrodes in the first direction are set to a ground level while sequentially changing the first drive electrodes on the line of the individual electrodes in the

first direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are set to a high-voltage level or the ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under the high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are set to the ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are set under the high-impedance state.

8. The electrostatic ejection type ink jet head according to claim 6, further comprising:

guard electrodes that are provided between the lines of the first drive electrodes in the first direction and is biased to a predetermined certain voltage level at the time of recording of the image,

wherein the ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the first drive electrodes on all lines of the individual

electrodes in the first direction are set to a high voltage level or a ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under a high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are at a ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are turned on or off in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are turned on and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are turned off while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are turned on.

9. An electrostatic ejection type ink jet head that uses ink containing a charged fine particle component, controls ejection/non-ejection of the ink by means of an

electrostatic force by applying a predetermined voltage to a plurality of individual electrodes arranged in a two-dimensional manner with reference to a first direction and a second direction in accordance with image data, and records an image corresponding to the image data on a recording medium,

the electrostatic ejection type ink jet head comprising:

a head substrate;

first drive electrodes and second drive electrodes each provided for each of the individual electrodes to form a two-layered electrode structure;

ink guides arranged on the head substrate for each of the individual electrodes; and

an insulating substrate in which through holes are established for each of the individual electrodes at a position corresponding to an arrangement of the ink guide,

wherein the head substrate and the insulating substrate are arranged with a predetermined space therebetween, a flow path of the ink is formed between the head substrate and the insulating substrate, the ink guides are passed through the through holes established in the insulating substrate, tip portion of the ink guides are protruded above a surface of the insulating substrate on a

recording medium side, the first drive electrodes are arranged closer to the insulating substrate than the flow path of the ink, the second drive electrodes are arranged closer to the head substrate side than the first drive electrodes, the first drive electrodes on each line of the plurality of individual electrodes arranged in the first direction are connected mutually, the second drive electrodes on the line of the plurality of individual electrodes arranged in the second direction are connected mutually, and the lines of the individual electrodes in the first direction are divided into a plurality of groups that each group contains at least one line, and

ejection/non-ejection of the ink at the time of recording of the image is controlled by simultaneously for the plurality of groups and sequentially repeating one of an operation (i) in which the second drive electrodes on all lines of the individual electrodes in the second direction are turned on or off in accordance with the image data under a state where the first drive electrodes on one line of the individual electrodes in the first direction are turned on and the first drive electrodes on all remaining lines of the individual electrodes in the first direction are turned off while sequentially changing the first drive electrodes on the line of the individual

electrodes in the first direction that are turned on, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are turned on or off in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are turned on and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are turned off while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are turned on.

10. The electrostatic ejection type ink jet head according to claim 9,

wherein the ejection/non-ejection of the ink at the time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the second drive electrodes on all lines of the individual electrodes in the second direction are set to a high voltage level or a ground level in accordance with the image data under a state where the first drive electrodes on one line of the individual electrodes in the first direction are set under a high-impedance state and the first drive electrodes on all remaining lines of the

individual electrodes in the first direction are set to a ground level while sequentially changing the first drive electrodes on the line of the individual electrodes in the first direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are set to a high-voltage level or the ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under the high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are set to the ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are set under the high-impedance state.

11. The electrostatic ejection type ink jet head according to claim 9, further comprising:

guard electrodes that are provided between the lines of the first drive electrodes in the first direction and is biased to a predetermined certain voltage level at the time of recording of the image,

wherein the ejection/non-ejection of the ink at the

time of recording of the image is controlled by sequentially repeating one of an operation (i) in which the first drive electrodes on all lines of the individual electrodes in the first direction are set to a high voltage level or a ground level in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are set under a high-impedance state and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are at a ground level while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are set under the high-impedance state, and an operation (ii) in which the first drive electrodes on all lines of the individual electrodes in the first direction are turned on or off in accordance with the image data under a state where the second drive electrodes on one line of the individual electrodes in the second direction are turned on and the second drive electrodes on all remaining lines of the individual electrodes in the second direction are turned off while sequentially changing the second drive electrodes on the line of the individual electrodes in the second direction that are turned on.

12. An electrostatic ejection type ink jet head that performs recording by ejecting ink containing charged fine particles by means of an electrostatic force, comprising:

a head substrate;

an insulating substrate arranged so as to be spaced from the head substrate by a certain distance and forms an ink flow path in a space with the head substrate;

an ink guide arranged on the head substrate so that tip portion thereof protrudes from a through hole established in the insulating substrate, and guides the ink flowing through the ink flow path from the ink flow path to the tip portion;

a drive electrode provided for a part of an inner wall of the ink flow path side of the insulating substrate in proximity to the ink guide so as to surround a periphery of the ink guide, and is used to eject the ink guided to the tip portion of the ink guide by means of the electrostatic force; and

a coating film coating the drive electrode and smoothing the inner wall of the ink flow path side.

13. An electrostatic ejection type ink jet head according to claim 12,

wherein on a surface of the insulating substrate on

an opposite side to the inner wall of the ink flow path side, another drive electrode used in combination with the drive electrode to eject the ink by means of the electrostatic force is provided in proximity to the ink guide so as to surround the periphery of the ink guide.

14. An electrostatic ejection type ink jet head according to claim 13,

wherein a plurality of sets of the ink guide, the through hole, the drive electrode, and the other drive electrode are arranged in a two-dimensional manner along a first direction and a second direction that is orthogonal to the first direction,

wherein the drive electrodes of the plurality of sets are connected to each other through wiring along the first direction, and

the other drive electrodes of the plurality of sets are connected to each other through wiring along the second direction.